



CRIODE



MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE
ET SOLIDAIRE

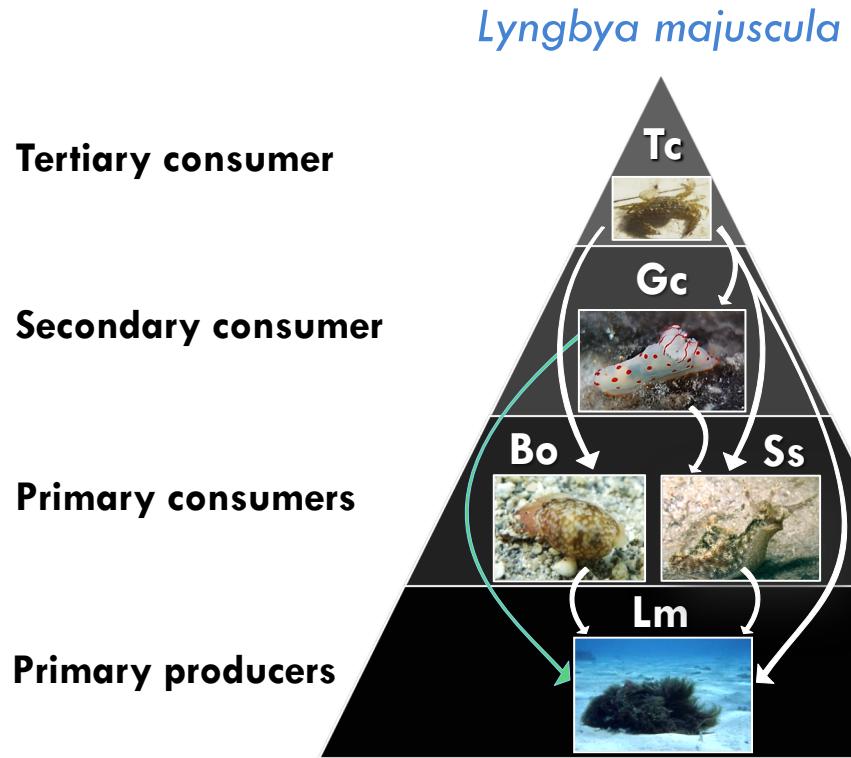


ECOSYSTEM

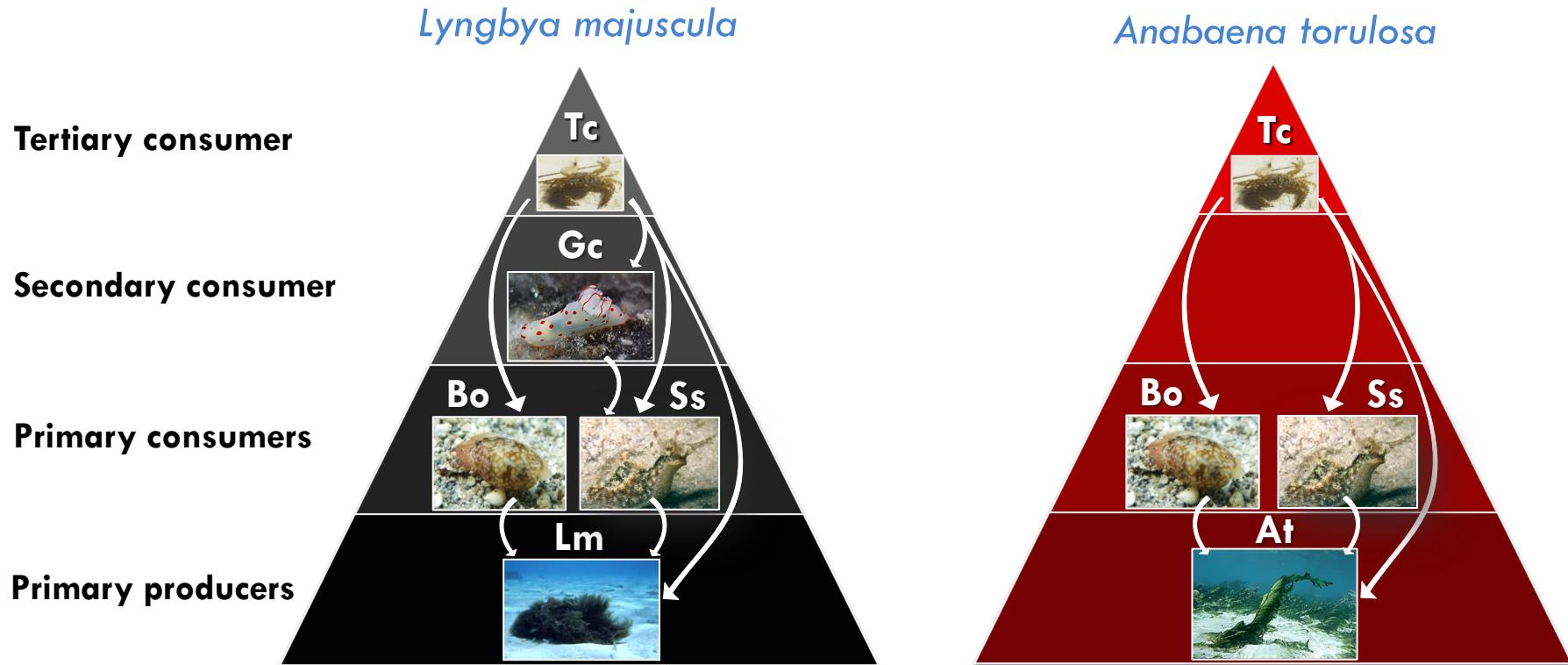
Ecosystem impacts: Cyanobacteria, CO₂ sequesters and producers of “keystone” molecules that structure coral reef ecosystems

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CRIODE, USR CNRS-EPHE-UPVD 3278
Moorea & Perpignan

Our model: a coral ecosystem with multi-trophic food webs



Our model: a coral ecosystem with multi-trophic food webs



Cyanobacterial secondary metabolites

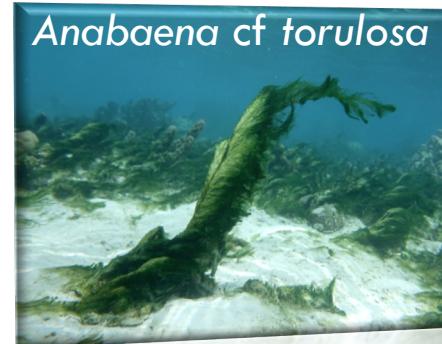


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**Do cyanobacterial secondary metabolites have a function
in structuring and functioning of these ecosystems?**



We have already characterized the metabolic profiles of both cyanobacteria.

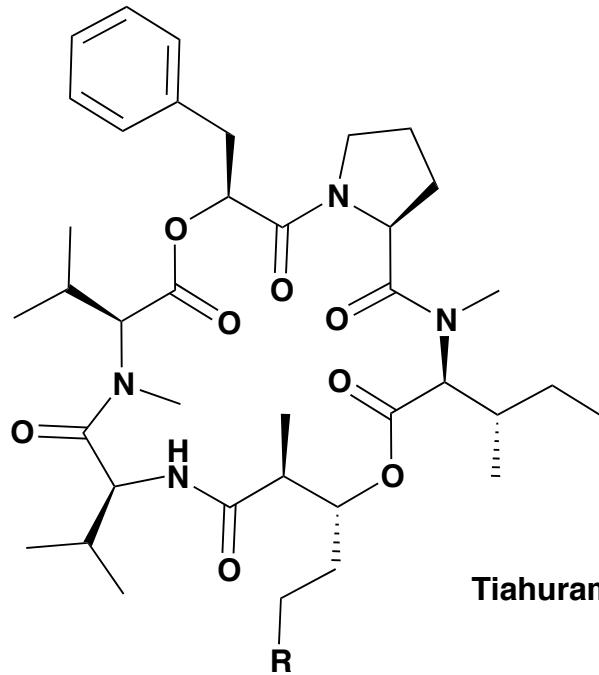
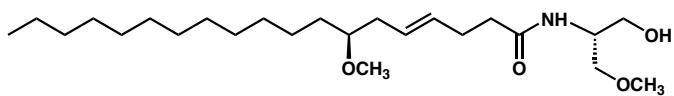
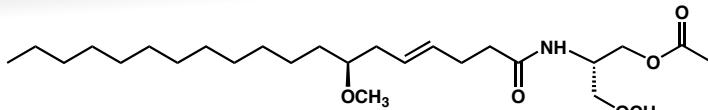
Secondary metabolites from *Lyngbya majuscula*



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Tiahuramides A-C

Lipopeptides from *Anabaena torulosa*



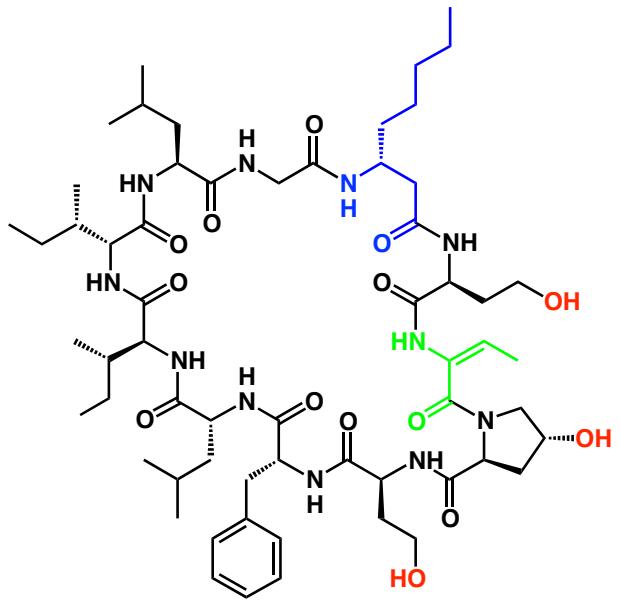
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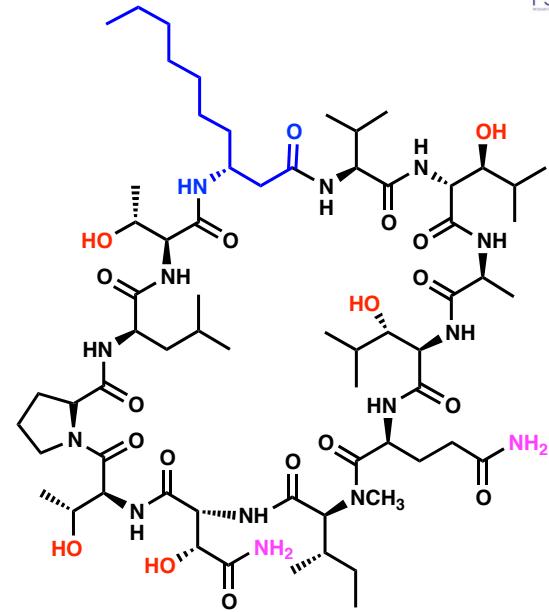
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Anabaena cf torulosa



Laxaphycines A



Laxaphycines B

Bonnard et al., *J. Med. Chem.* 2007

Boyaud et al., *Org. Lett.* 2013

Bornancin et al., *Marine Drugs* 2015

Pennings et al., *Limnol. Oceanogr.* 1997

Cyanobacterial metabolites in the trophic web

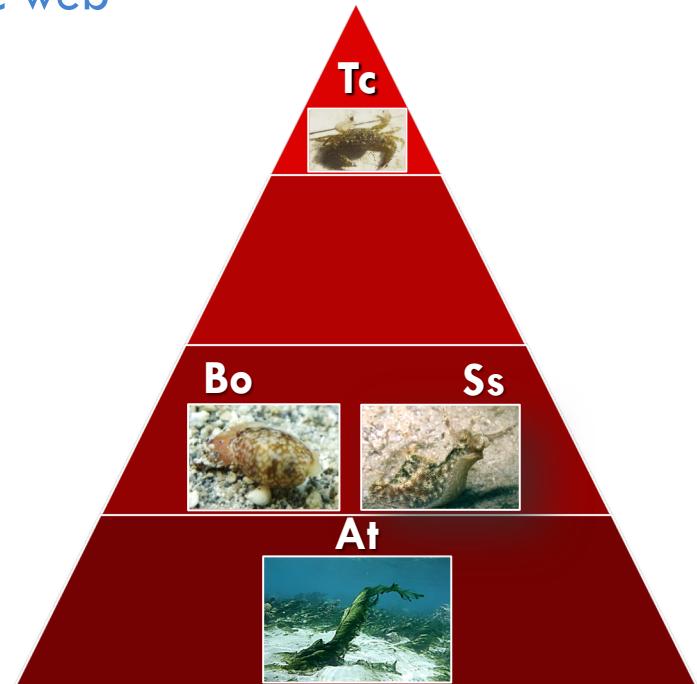
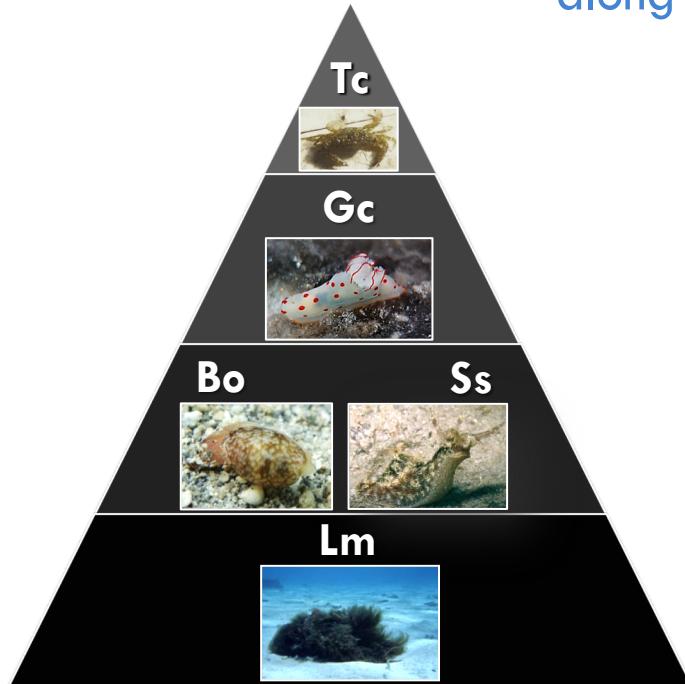


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Transmission and biotransformation of cyanobacterial metabolites
along the trophic web



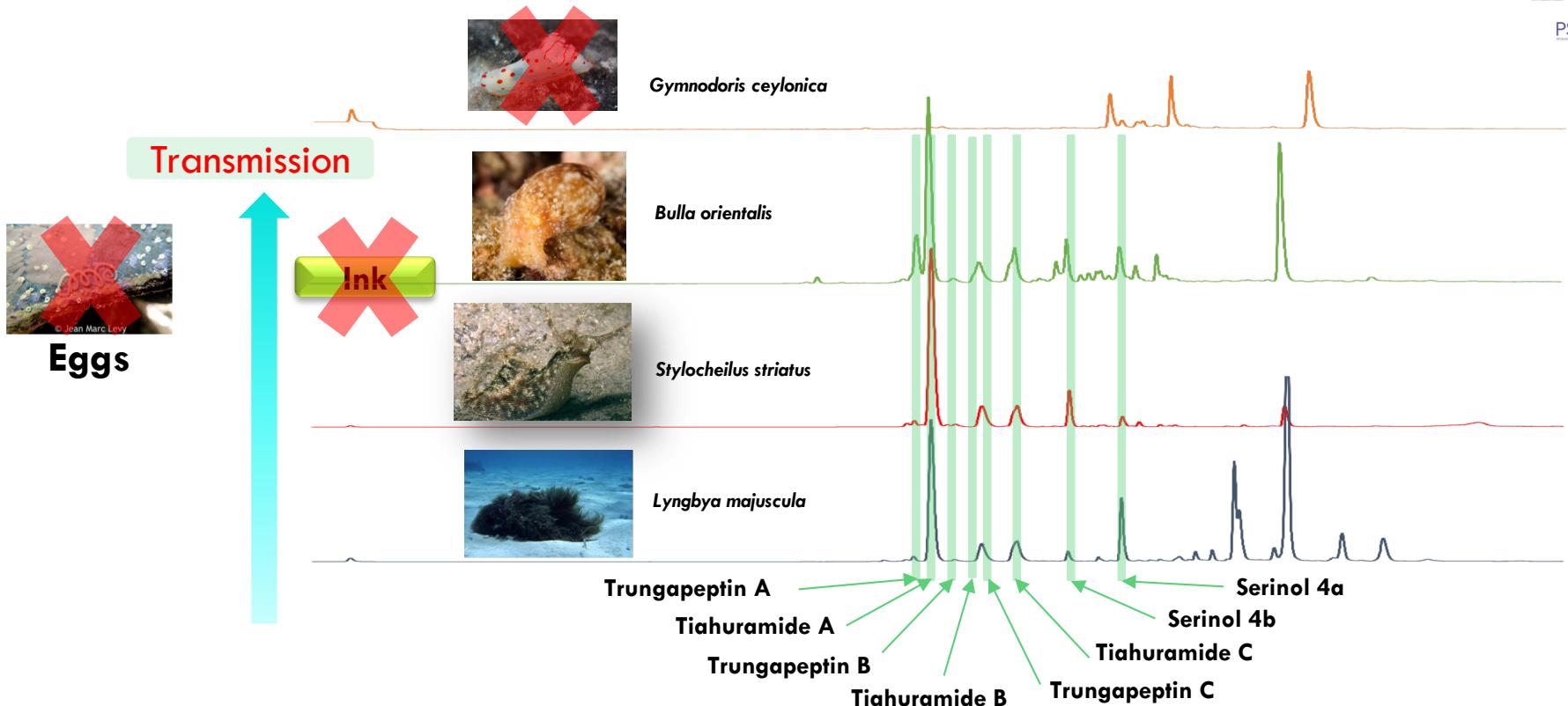
Transmission of *Lyngbya* secondary metabolites



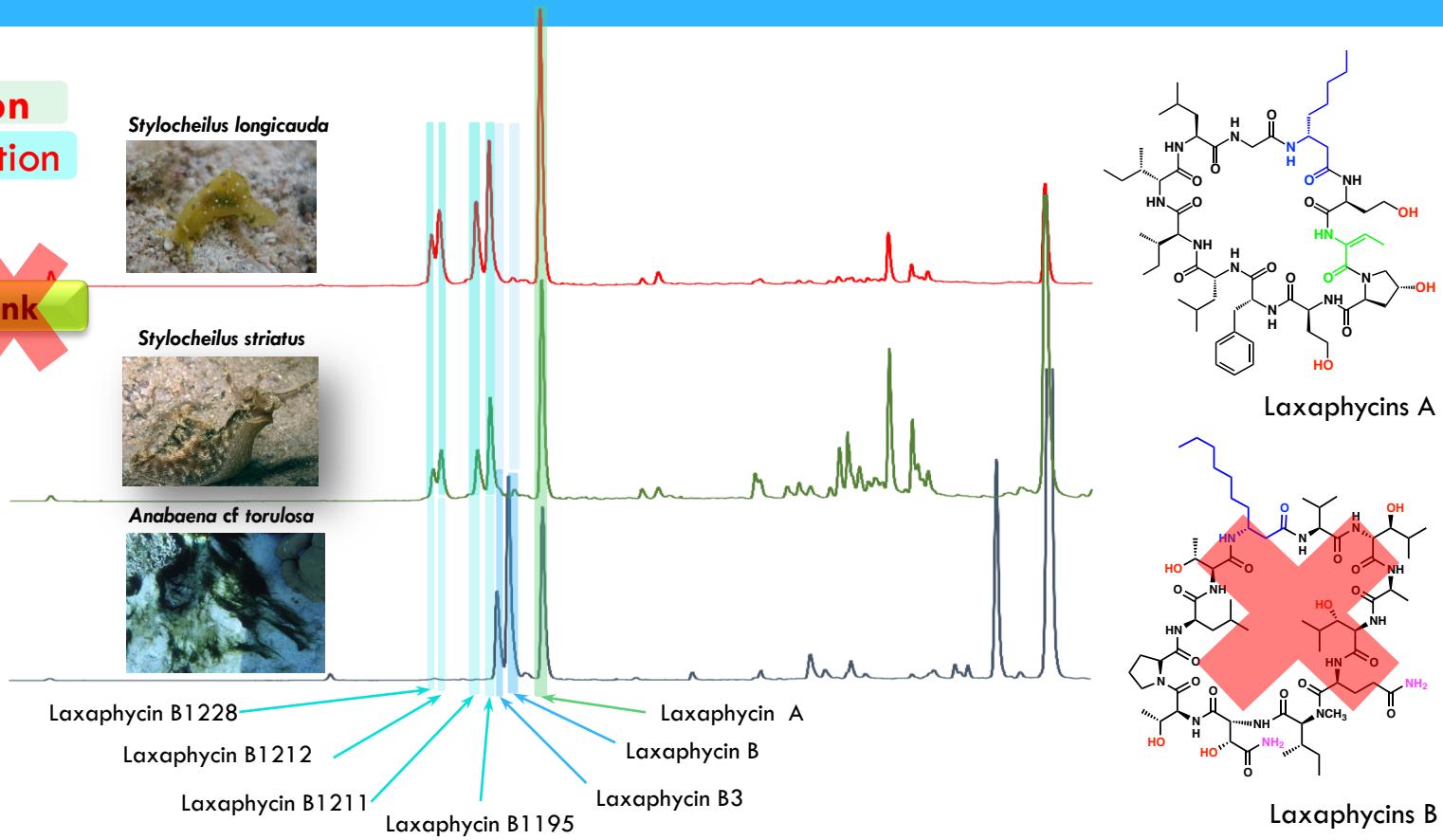
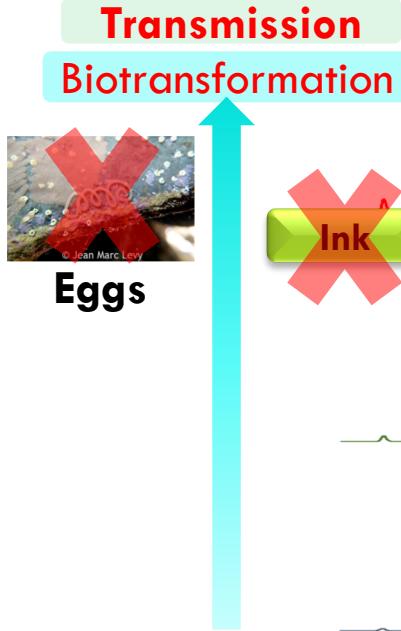
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Transmission of Anabaena secondary metabolites



Cyanobacterial secondary metabolites

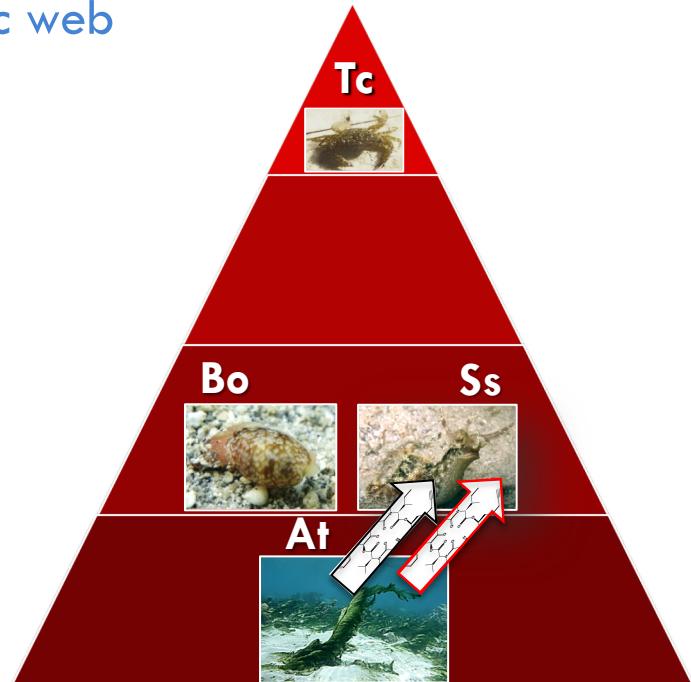
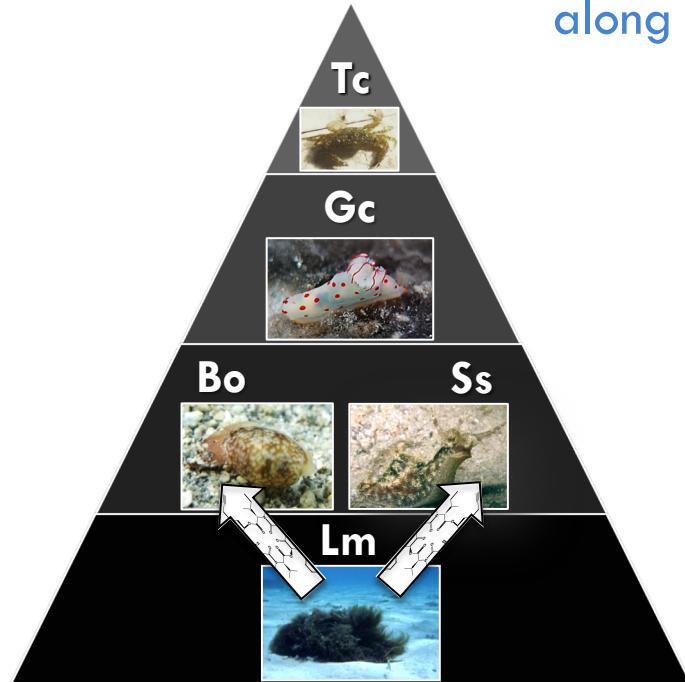


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Transmission and biotransformation of cyanobacterial metabolites
along the trophic web



Cyanobacterial secondary metabolites

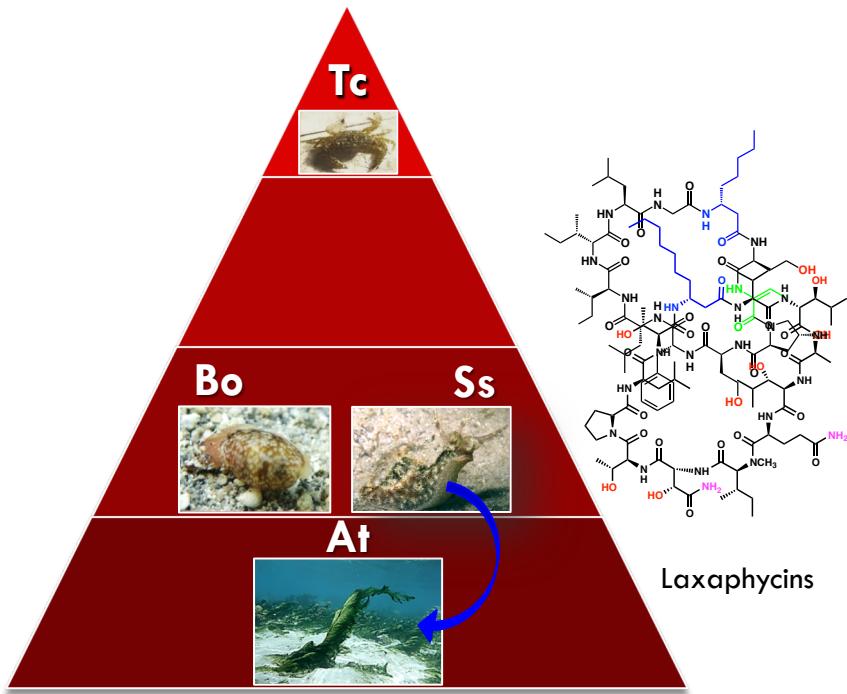
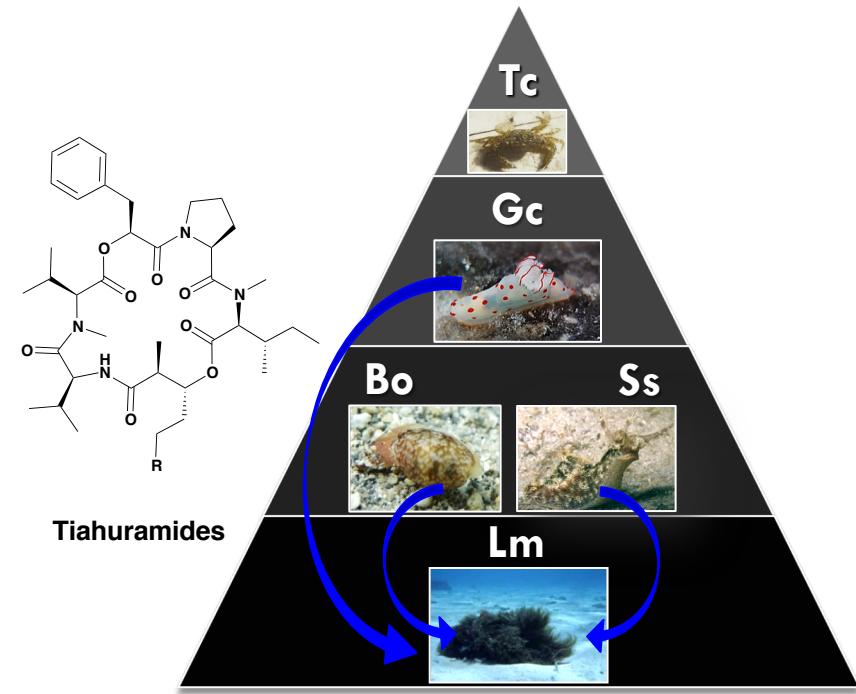


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The role of cyanobacterial secondary metabolites
in olfactory and gustatory perception of herbivores



Ecosystem consequences of global change

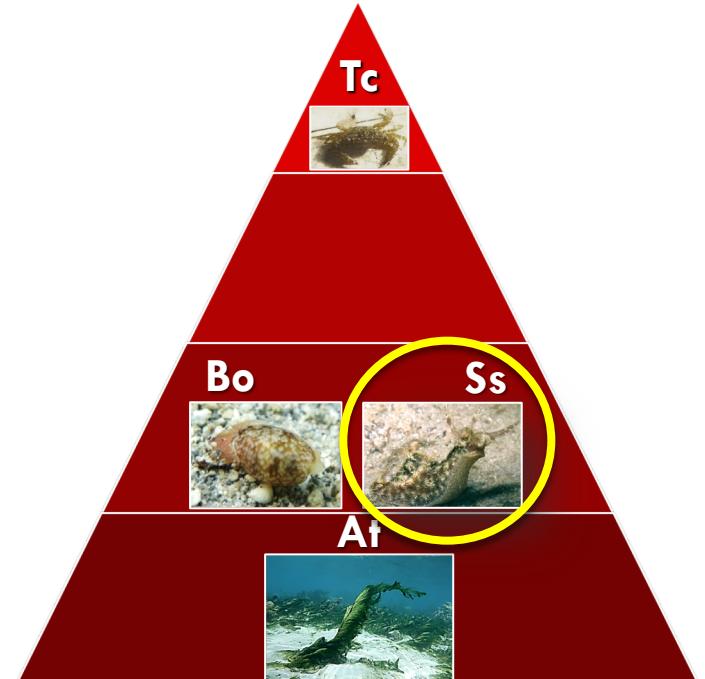
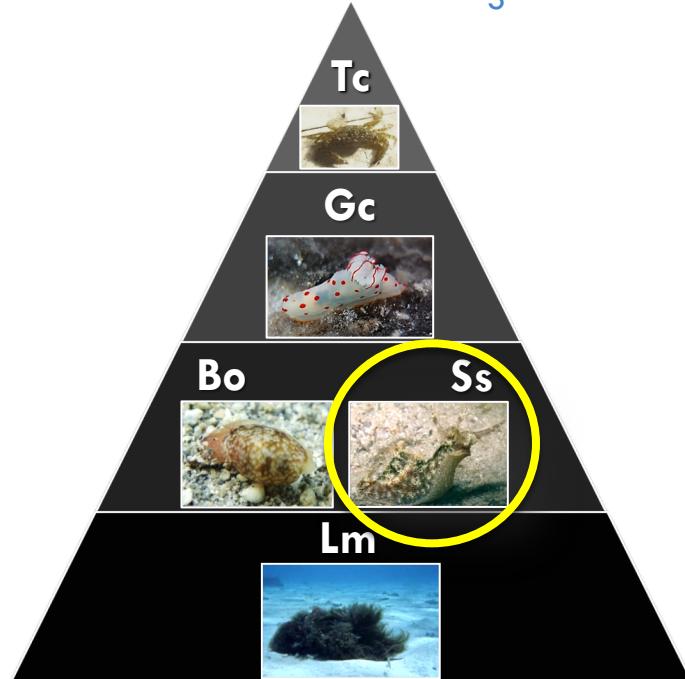


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Cyanobacteria are predicted to increase with climate change, others with
 CaCO_3 structures, are predicted to decrease

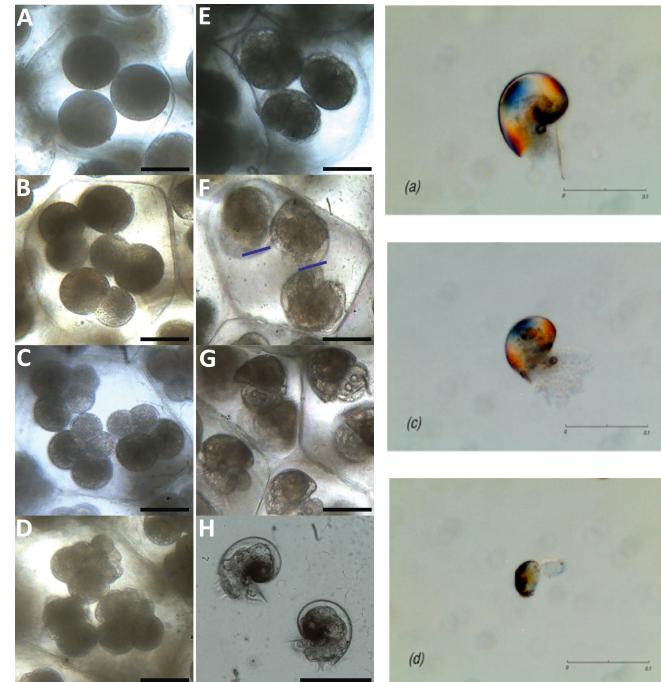


Ecosystem consequences of global change

Short-term responses of elevated temperature and ocean acidification on *Stylocheilus striatus*:



- embryonic development (CaCO_3 shell distortion),
- lower hatching and survival.

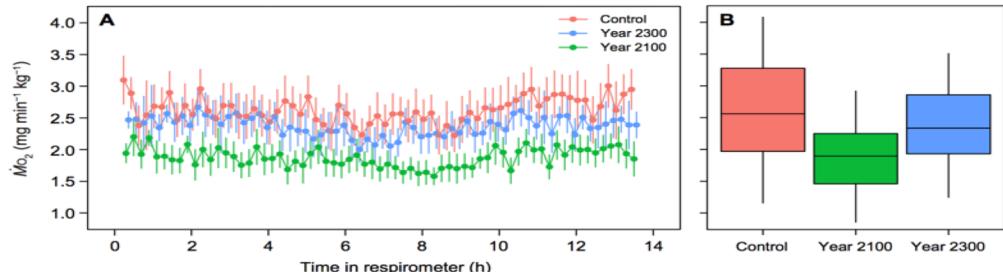


Ecosystem consequences of global change

Developmental acclimation of *S. striatus* to elevated temperature and ocean acidification.



- Embryonic development,
- reproductive behaviour,
- physiology,
- escape from predation.



Ecosystem consequences of global change

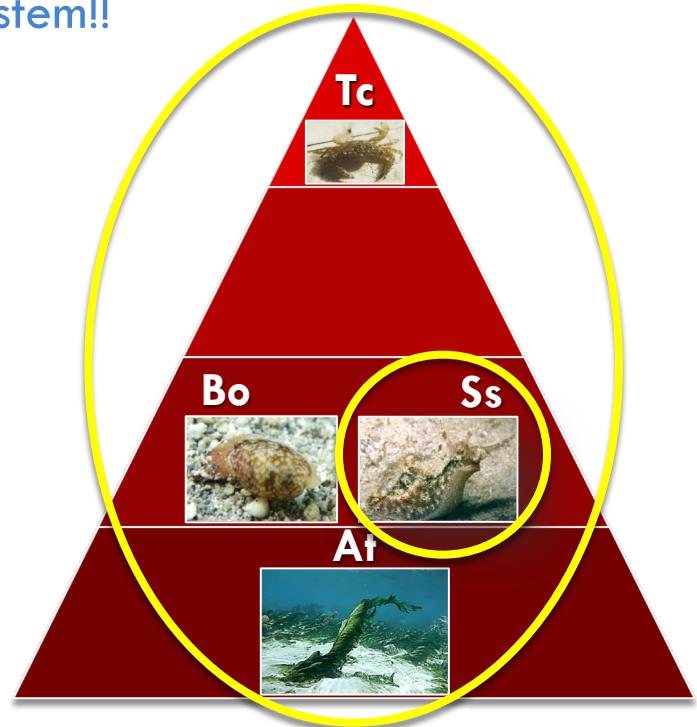
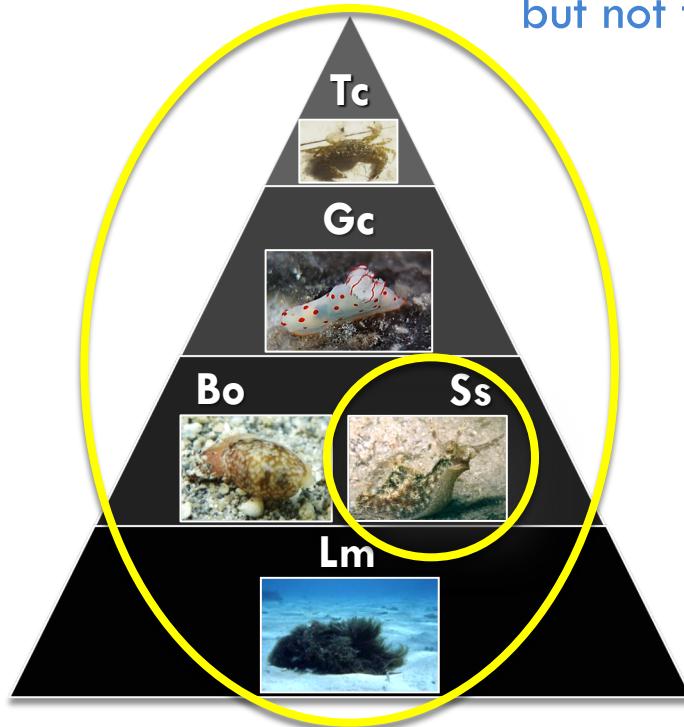


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We know the response of one herbivore to acidification,
but not the entire ecosystem!!



FRB project: ECOSYSTEM 2017-2020



Within coral reef ecosystems, our goal is to study the impact of ocean acidification and elevated temperatures on:

- 1) the behaviour of all the partners, as well as the interactions between the different species,
- 2) the perturbation of chemical mediation between the different species,
- 3) and to measure the acclimation potential of a reef ecosystem.
- 0) ~~the CO₂ sequestration abilities of both cyanobacteria, and to determine if this sequestration is affected by elevated sequestration,~~

FRB project: ECOSYSTEM 2017-2020

Goal 1

Determine how OA and elevated Temp affect the behaviour of all partners, as well as all the interactions between the different species within these two ecosystems.

3 treatments:

- Foraging: Olfactory and gustatory tests
- Predation: Predator-prey escape responses
- Reproduction and embryonic development
- Whole ecosystem responses:

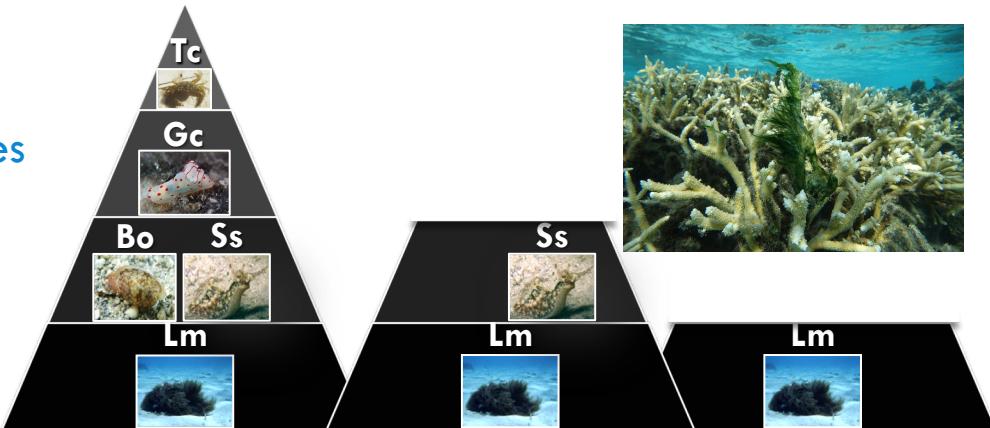
Control

2100

predictions

2300

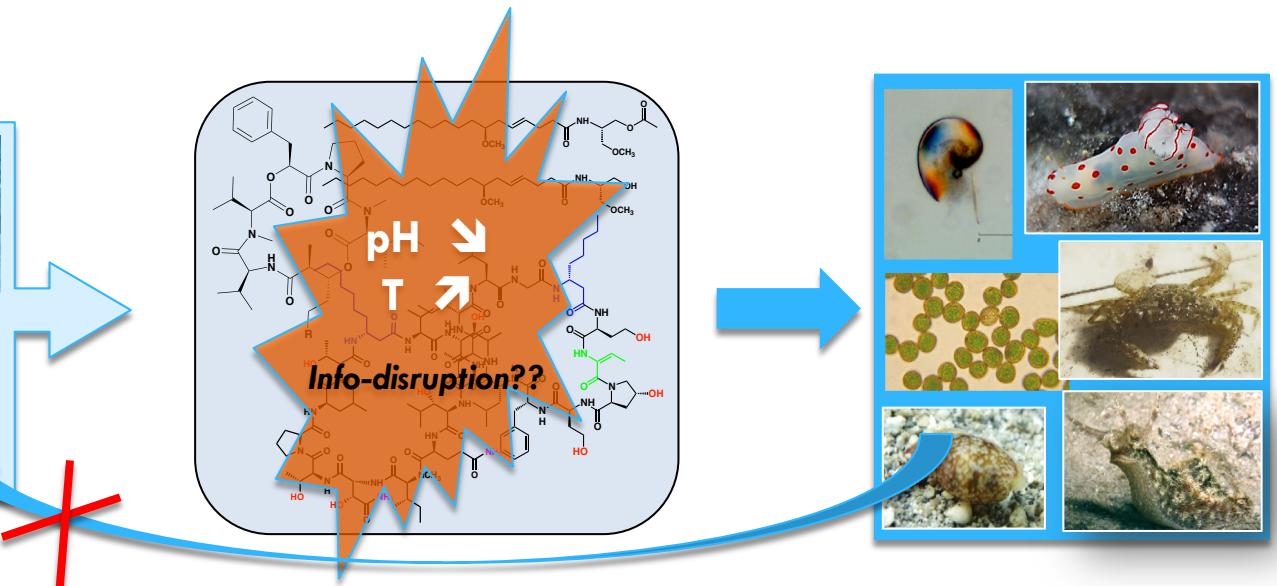
predictions



FRB project: ECOSYSTEM 2017-2020

Goal 2

Determine the impact of OA and elevated Temp on chemical mediation, particularly on the phenomena of attraction/repulsion in these two ecosystems.

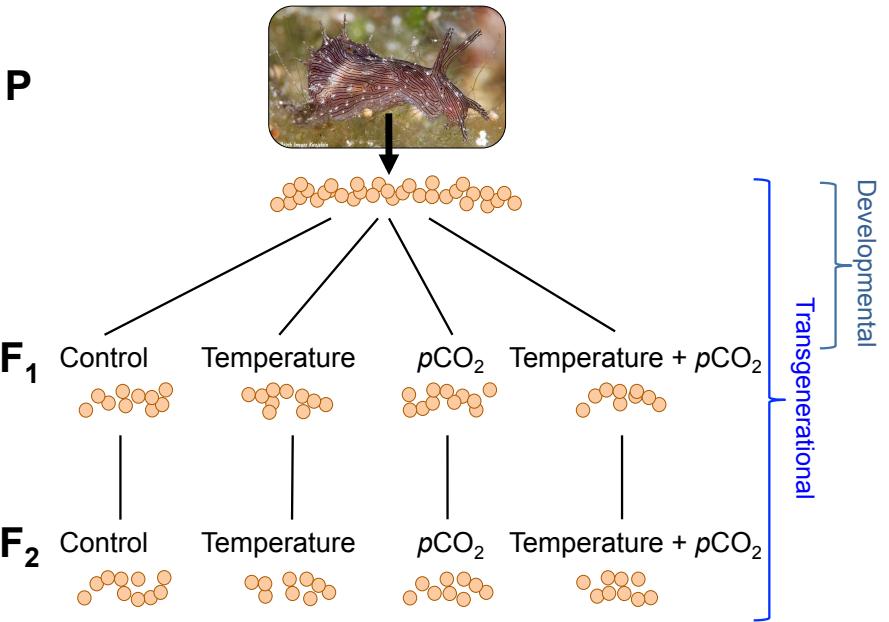


FRB project: ECOSYSTEM 2017-2020

Goal 3

Measure the acclimation potential of a reef ecosystem confronted with ocean acidification and elevated temperatures.

Rapid generation time (2 months):
trans-generational acclimation



Merci

L'équipe



Natural Product Reports

REVIEW



Cite this: *Nat. Prod. Rep.*, 2017, 34, 644

Chemical mediation as a structuring element in marine gastropod predator-prey interactions

L. Bornancin,^{*a} I. Bonnard,^{ac} S. C. Mills^{bc} and B. Banaigs^{ID, *ac}



Armstrong, E.J., Allen, T., Beltrand, M., Dubousquet, V., Stillman, J.H. & Mills, S.C. 2017. Interactive effects of ocean acidification and warming on the development and physiology of a mollusc, *Stylocheilus striatus*. *Marine Biology* 164: 107.

Bornancin, L., Bonnard, I., Mills, S.C. & Banaigs, B. 2017. *Natural Products Report* 34: 644-676 (IF=10.98).

Horwitz, R., Jackson, M. & Mills, S.C. 2017. The embryonic life-history of the tropical sea hare *Stylocheilus striatus* under ambient and elevated ocean temperatures. *PeerJ* 5:e2956.